This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LELAND STANFORD JUNIOR UNIVERSITY
JAN 1907
REGISTER

College Entrance Examination Board

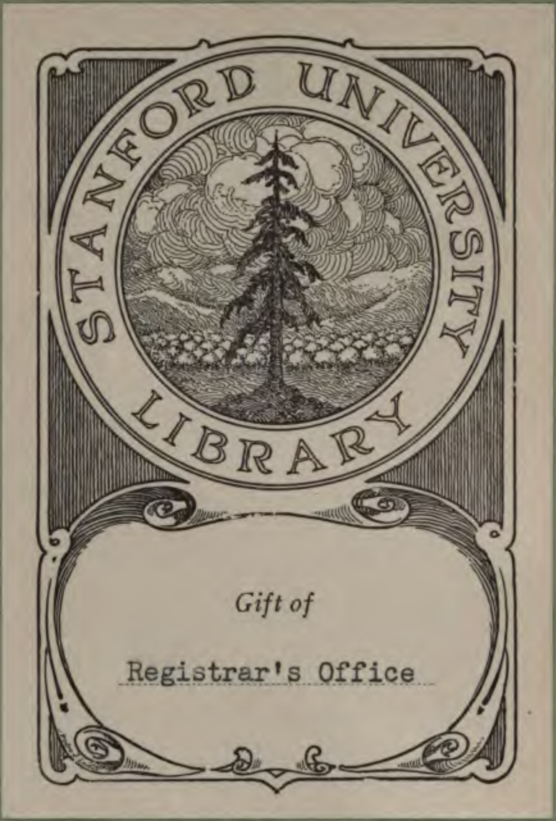
EXAMINATION QUESTIONS
IN
BOTANY DRAWING
CHEMISTRY GEOGRAPHY
PHYSICS

1901-1905

basement

GINN & COMPANY
BOSTON · NEW YORK · CHICAGO · LONDON

378.211
C697b



STANFORD UNIVERSITY LIBRARY

Gift of

Registrar's Office

College Entrance Examination Board

EXAMINATION QUESTIONS
IN
BOTANY DRAWING
CHEMISTRY GEOGRAPHY
PHYSICS

1901-1905

GINN & COMPANY
BOSTON · NEW YORK · CHICAGO · LONDON

524011

COPYRIGHT, 1905
BY THE
COLLEGE ENTRANCE EXAMINATION BOARD

ALL RIGHTS RESERVED

55.11

PREFACE

While the annual volume of examination questions published by the College Entrance Examination Board has met the needs of many candidates for examination and their teachers, the Board has been constantly in receipt of communications asking for the questions set in certain subjects in successive years. In order to meet this demand the Board has prepared five different pamphlets, each containing the questions in certain subjects from 1901 to 1905 inclusive. These pamphlets are as follows:

1. Examination questions in Latin and Greek, 1901–1905.
2. Examination questions in English and other modern languages, 1901–1905.
3. Examination questions in mathematics, 1901–1905.
4. Examination questions in history, 1901–1905.
5. Examination questions in the natural sciences and in drawing, 1901–1905.

Besides meeting the needs of candidates for examination and their teachers, these publications ought to have more widely a beneficial influence upon teaching for the reason that they illustrate in concrete form principles agreed upon by many leading teachers of the subjects represented.

CONTENTS

PAGE

BOTANY 7

CHEMISTRY 13

DRAWING 23

GEOGRAPHY 33

PHYSICS 41

BOTANY

1902

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

Saturday, June 21 **BOTANY** **9.15–10.45 a. m.**

Answer any eight of the following questions:

In this examination 36 counts will be based upon the laboratory note book, and 64 upon the following questions:

1 What are the essential parts of a seed, and what is the use of each part?

2 What principal modifications of form and function occur in leaves?

3 What is the structure of a typical plant-cell? (Illustrate by sketches.) In what principal ways, and in response to what functions may the structure be modified?

4 What are the facts in the processes of photosynthesis ("assimilation") and respiration, and what is the fundamental meaning of each process?

5 Through what structures, and by what physical processes, is water absorbed into and given off from ordinary land plants?

6 What are the principal methods, and the corresponding adaptive structures, by which the cross-pollination of flowers is secured? What is the use or other meaning of the process to the plant?

7 What are the facts in the habits, and in the structure and reproduction of the principal one of the algae studied by you? (Illustrate by sketches.)

8 What connections between structure and habit (adaptations) can you trace in the principal fungi studied by you?

9 Give an account of the life-history of a fern. (Illustrate by sketches.)

10 What are the principal subdivisions of the angiosperms? What are some (twenty or more) of the leading families of the flowering plants? What are the distinguishing characteristics of two of the leading families?

Examiners

WILLIAM F. GANONG
Smith College

BYRON D. HALSTED
Rutgers College

EDWARD L. MORRIS
Western High School,
Washington, D. C.

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

BOTANY

Saturday, June 20 1–2.30 p. m.

Answer any eight of the following questions:

In this examination 36 counts will be based upon the laboratory note-book, and 64 upon the following questions:

1 Sketch the structure of a typical complete flower, and mention the functions of the several parts.

2 Give an account of the appearance and structure of the protoplasm of plants.

3 By what physical processes and through what parts is water absorbed into plants, and what are its various uses?

4 What are the growing parts in the stem and root of an exogenous tree? (Illustrate by sketches.)

5 Define five of the following: transpiration, geotropism, respiration, saprophytes, xerophytes, sporangia, carpels, ecology.

6 What are the principal methods used by plants to secure the dissemination of their reproductive bodies?

7 What adaptations to their particular habitat do water plants and desert plants show?

8 Describe the structure and reproduction of a fungus and an alga studied by you. (Illustrate by sketches.)

9 In what essential characters do bryophytes differ from pteridophytes?

10 How do monocotyledons differ from dicotyledons, and what are the principal families of the former?

Examiners

William F. Ganong
Smith College

Byron D. Halsted
Rutgers College

Edward L. Morris
Central High School,
Washington, D. C.

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

BOTANY

Saturday, June 25 1–2.30 p. m.

Answer any seven of the following questions.

In this examination 37 counts will be based upon the laboratory note-book, and 63 upon the following questions.

1 Describe, with sketches, the seed and the phenomena and stages in the germination and early growth of the corn or of the bean.

2 What in general is the use of the fruit to the plant? Briefly describe, with outline sketches, four different types of fruits, indicating the method by which their function is performed.

3 Name the principal physiological processes of plants, with a brief definition of each. Explain the operation of some one of them.

4 What are the principal differences in structure and mode of growth between roots and stems?

5 Describe, with a sketch, a living plant cell you have studied.

6 Give an account of the passage of water from the soil through the plant into the air, with especial reference to the parts through which it passes, and the forces producing the movement.

7 Name five special situations (habitats) occupied by plants, and briefly describe how the plants are adapted to them.

8 What parts in some bryophyte known to you are morphologically equivalent to the parts in a typical flowering plant?

9 Describe the life-history of some fungus or alga studied by you, illustrating the chief points by sketches.

10 Give a synopsis of the distinguishing characteristics of six families of flowering plants.

Examiners

William F. Ganong
Smith College

Henrietta E. Hooker
Mount Holyoke College

Louis Murbach
Central High School,
Detroit, Mich.

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

BOTANY

Saturday, June 24 1–2.30 p. m.

Answer any seven of the following questions.

In this examination 37 counts will be based upon the laboratory note book, and 63 upon the following questions.

1 What are the organs of a typical higher (or seed) plant, and what part does each play in the life of the plant?

2 Describe the internal structure of a typical leaf, stem and root, illustrating your answer by a drawing of a cross section of each.

3 Explain the use of water in the higher plants; also how water is taken in; also how it is given off. Describe experiments illustrating the two latter subjects.

4 What are the differences, as to processes and use to the plant, between respiration and photosynthesis (food-preparation) in green plants?

5 Describe the principal methods by which *one* of the following is secured by plants: (*a*) dissemination, (*b*) cross-pollination. Of what advantage is the process to the plant?

6 What processes are involved in the formation of a seed and its unfolding to a young plant? Illustrate your answer by drawings where possible.

7 Describe briefly, with illustrative drawings, the life history of some alga.

8 Describe in botanical language three plants studied by you, referring them to their proper order, genus and species.

9 What do you know as to the classification of plants into the larger groups? Indicate the relationships of these groups by some form of diagram.

10 Select some botanical topic not included in the questions above, and write a brief exposition of it.

Examiners

William F. Ganong
Smith College

Henrietta E. Hooker
Mount Holyoke College

Louis Murbach
Central High School,
Detroit, Mich.

CHEMISTRY

1901

College Entrance Examination Board

OF THE

MIDDLE STATES AND MARYLAND

SUB-STATION 84, NEW YORK, N. Y.

Tuesday, June 18 **CHEMISTRY** 3–4.30 p. m.

Answer any six of the following questions:
In this examination 40 counts will be based upon the laboratory note book, and 60 upon the following questions:

1 Describe one experiment to determine the composition of water by volume, and one experiment to determine its composition by weight. Express the results in a chemical formula, and explain the formula.

2 Put down in tabular form the properties of the oxides of nitrogen. How can you distinguish nitrogen monoxide from oxygen?

3 Complete the following equations, assuming that *all* of the hydrogen in each acid is replaced by the metal. Name every substance:

$Ca(OH)_2 + H_3PO_3 =$
$Al(OH)_3 + H_4SiO_4 =$
$Na(OH) + H_2SO_3 =$
$Mg(OH)_2 + H_3PO_4 =$

4

Gaseous compounds	Analyses	Specific gravities
Hx	$H : x = 1 : 3$	0.557
Ox	$O : x = 8 : 3$	1.529
HNx	$H : N : x = 2 : 28 : 24$	0.948

In the above table we have gaseous compounds of an element, x. The analyses of the compounds are given; also the specific gravities, air being unity. Air is 14.4 as heavy as hydrogen. What is the atomic weight of this element x? Give reasons.

5 How is sodium carbonate made? Give the formula of alum, caustic potash, cryolite, Glauber's salt, Epsom salt, and borax.

6 Describe the preparation of iron, commencing with the ore and finishing with Bessemer steel. Draw diagrams of a furnace and of a converter.

7 Describe the metallurgy of lead, *or* of silver, *or* of zinc. Name some important compounds of each of these metals.

8 Name and give the formula of

a) A hydrocarbon from petroleum; *b*) A hydrocarbon from coal-tar; *c*) A carbon acid (not carbonic acid); *d*) An ether; and *e*) An ethereal salt.

9 In the following equation, if 20 grams of saltpetre are used, what weight of sulfuric acid will be required, and what weight of each product will be formed?

$2KNO_3 + H_2SO_4 = 2HNO_3 + K_2SO_4$
Atomic weights, $K = 39$; $N = 14$; $O = 16$; $S = 32$; $H = 1$.

Examiners

IRA REMSEN	CLARENCE L. SPEYERS	ROBERT H. CORNISH
Johns Hopkins University	Rutgers College	Wadleigh High School, New York

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

Tuesday, June 17 **CHEMISTRY** 3-4.30 p. m.

Answer any seven of the following questions:

In this examination 30 counts will be based upon the laboratory note book, and 70 upon the following questions:

1 What is ordinary combustion and what are the conditions essential to it? In what respects does the rusting of iron resemble and in what respects does it differ from the burning of a candle? How may it be shown that the terms "combustible substance" and "supporter of combustion," as applied to gases, are relative and interchangeable?

2 What are the constituents of the atmosphere? Which of these constituents are of special importance to animal life and which to vegetable life? What is returned to the atmosphere by animals, and what is returned by plants? Give one or more facts to show that the two principal constituents of the atmosphere are not in chemical combination.

3 A mixture of 30 c. c. of air and 40 c. c. of hydrogen is introduced into a eudiometer tube and the mixture ignited by an electric spark. The gas remaining in the tube after the explosion measures 51.1 c. c. What per cent by volume of oxygen is contained in the air used, assuming that the gases are all measured at the same temperature? Explain.

4 State the laws of definite and multiple proportions, and illustrate each by an example. Distinguish between analysis, synthesis and metathesis, and give an example of each. Name laboratory experiments which illustrate what is meant by the terms "oxidation" and "reduction."

5 Give the chemical name of each of the following substances: salammoniac, Chili saltpetre, slaked lime, plaster of Paris. Complete the following equations, using formulas:

Ammonium nitrate (heated) =
Calcium carbonate + hydrochloric acid =
Ferrous sulphide + sulphuric acid =

State, in words, the general chemical character of any two of the following substances: (*a*) a soap, (*b*) a glass, (*c*) a steel, (*d*) a coal.

6 What are the characteristic properties of (*a*) acids, (*b*) bases? Distinguish between a normal and an acid salt and illustrate each by an example, giving name and formula. Show what becomes of the hydrogen of sulphuric acid when each of the following is dissolved in it: (*a*) metallic zinc, (*b*) zinc oxide (ZnO), (*c*) zinc hydroxide ($Zn(OH)_2$).

7 What is the commercial source of ammonia? How may it be prepared for experimental purposes? How may it be shown that ammonia (*a*) has the character of an alkali, (*b*) is lighter than air, (*c*) is readily soluble in water?

8 Outline and explain a commercial process for the manufacture of sulphuric acid (omitting reactions). Give three important compounds of sulphuric acid and their common names.

9 Outline the manufacture of coal gas for illuminating purposes and name three of the useful by-products.

Why are the compounds of carbon with hydrogen, and their derivatives, treated as a separate branch of chemistry? Give two names by which this branch of chemistry is known.

10 How many liters of hydrogen will be produced by the action of hydrochloric acid on 50 grams of zinc, assuming the weight of a liter of hydrogen to be 0.0896 gram under the conditions of temperature and pressure prevailing at the time of measuring the volume of the gas?

Calculate the percentage composition of ammonia (NH_3).

Atomic weights: N=14, Zn=65.

Examiners

HENRY P. TALBOT	LEVERETT MEARS	ALBERT CABLE HALE
Massachusetts Institute of Technology	Williams College	Boys' High School, Brooklyn

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

CHEMISTRY

Tuesday, June 16 3–4.30 p. m.

Answer question 9, or question 10, and any six of the others:
In this examination 30 counts will be based upon the laboratory note-book, and 70 upon the following questions:

1 Distinguish between chemical change and physical change, and give an example of each. Distinguish between a chemical element, a chemical compound, and a mixture.

Explain the significance of a chemical equation.

2 Describe a method for preparing oxygen in quantity, and make a sketch of the apparatus used. State the important chemical and physical properties of oxygen, and its uses.

Give three methods for collecting gases, and the conditions under which each may be advantageously employed.

3 Name the members of the halogen group of elements. Describe a method for the preparation of chlorine, including the precautions to be taken in carrying out the process. Give the important chemical and physical properties of chlorine.

Describe and explain the action which occurs when chlorine-water is added to a solution of potassium iodide containing starch.

4 Name three allotropic forms of carbon, and show how their chemical identity may be proved. How do hard and soft coals differ? By what other names are they generally known? What is coke, and how is it obtained?

By what reaction may carbon dioxide be distinguished from carbon monoxide?

5 Give the chemical name of each of the following substances: calomel, brimstone, fire-damp, choke-damp, muriatic acid, oil of vitriol, copperas.

Complete the following equations, using formulas:

Nitric acid + sodium carbonate =
Ammonium chloride + caustic soda =
Water + metallic sodium =
Manganese dioxide + hydrochloric acid =

6 Classify the compounds given below under the following headings: (*a*) acids, (*b*) bases, (*c*) normal salts, (*d*) acid salts, (*e*) anhydrides, (*f*) oxides.

CO_2, $NaHSO_4$, $CaCl_2$, PbO, H_3PO_4, $Ca(OH)_2$, Na_2SO_3, MnO_2, SO_2

Make a sketch of an apparatus employed for the electrolysis of water explain the process, and state the significance of the result.

7 What is meant by "hardness" in waters? Give a method for distinguishing between hard and soft waters, and explain the cause of "permanent" hardness? How can the latter be removed? Give two important tests for impurities in drinking waters.

8 How is lime prepared? What is the action of the atmosphere upon it? What is mortar? How is it prepared and what chemical changes occur when it hardens?

How may a ferrous salt be prepared? A ferric salt? Give a special test for each.

9 What volume of nitrous oxide (N_2O), measured at 0° and 750 mm., would be evolved by the decomposition of 10 grams of ammonium nitrate, assuming the weight of one liter of nitrous oxide at 0° and 760 mm. to be 1.97 grams? Atomic weights: $N=14$, $O=16$, $H=1$.

Give another name for nitrous oxide, and give its properties and uses.

10 How many cubic centimeters of sulphuric acid, containing 49 grams of H_2SO_4 per liter, will be required to neutralize 2 grams of sodium hydroxide? Atomic weights: $Na=23$, $S=32$, $O=16$, $H=1$.

What is meant by "neutralization"? Explain the use of indicators.

Examiners

HENRY P. TALBOT	LEVERETT MEARS	ALBERT CABLE HALE
Massachusetts Institute of Technology	Williams College	Boys' High School, Brooklyn

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

CHEMISTRY

Tuesday, June 21 2.55–4.25 p. m.

Answer question 9, or question 10, and any six of the others.

In this examination 30 counts will be based upon the laboratory note-book, and 70 upon the following questions.

1 Define the following terms: alloy, amalgam, deliquescence, efflorescence, water of crystallization.

What is a radical? Give an example of the use of radicals in formulas of chemical compounds.

2 What is a flame? What are the conditions essential to (*a*) its luminosity, (*b*) its maximum temperature?

Make a sketch of a Bunsen burner and its flame, illustrating in detail and explaining the parts of each.

3 Write the equation for preparing hydrofluoric acid; describe and explain the process of etching glass.

State the physical properties of bromine and iodine and two methods of identifying the latter.

4 Name an ore of each of the following metals: iron, lead, zinc, and mercury.

Give a test for a metal in each of the following ways:

(*a*) By flame coloration.
(*b*) By the borax bead.
(*c*) By the blowpipe on charcoal.

[Different metals may be selected for the different tests.]

5 Give a chemical method of distinguishing between the following gases:

(*a*) Hydrogen and carbon monoxide.
(*b*) Hydrogen chloride and sulphur dioxide.
(*c*) Oxygen and nitrous oxide.
(*d*) Nitrogen and carbon dioxide.

6 Write equations showing the result of adding sulphuric acid to (*a*) iron, (*b*) quick lime, (*c*) a solution of barium chloride. What is the chemical change which takes place when strong sulphuric acid is added to sugar?

What is the essential character of the common animal fats? Explain the process of soap-making. What is the difference between "hard" and "soft" soaps?

7 Explain the terms, "ion" and "ionization". What classes of substances are ionized when dissolved in water? By what term are all such substances designated? Define acid and base in terms of the theory of electrolytic dissociation.

Explain by the ion-theory the action of hydrochloric acid on potassium hydroxide in dilute solution.

8 Explain the natural grouping of the elements as expressed by the periodic law. Show how this is illustrated in some group classified according to this law; mention some important service which this law has rendered to chemistry.

9 What volume at 20° C. and under a pressure of two atmospheres will 100 liters of sulphur dioxide, measured at 0° C. and under a pressure of one atmosphere, occupy?

What weight of sulphur is necessary to produce this amount of sulphur dioxide? [Atomic weight of sulphur=32.]

10 A mixture of 10 c. c. of hydrogen and 10 c. c. of chlorine, exploded by an electric spark, yields 20 c. c. of hydrogen chloride. Show how this indicates that the molecule of hydrogen consists of at least two atoms.

Determine the molecular formula of a compound from the following data: composition—carbon 80%, hydrogen 20%; vapor density 15. [Atomic weight of carbon=12.]

Examiners

LEVERETT MEARS	CHARLOTTE F. ROBERTS	ALBERT CABLE HALE
Williams College	Wellesley College	Boys' High School, Brooklyn

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

CHEMISTRY

Tuesday, June 20 2.55–4.25 p. m.

In this examination 30 counts will be based on the laboratory note book submitted by the candidate, and 70 counts on the following questions.

The candidate is to answer seven questions, selecting two from each of the groups A, B and C, and one from Group D.

A

1 Give a brief account of the discovery of any one of the chemical elements, including the name of the discoverer and the approximate date and conditions of discovery.

Name three classes or kinds of chemical change, and write an equation to illustrate each.

2 Define the following terms: molecule, atom, ion, nascent state. Under what conditions is hydrogen supposed to exist (*a*) in the molecular state, (*b*) as an atom, (*c*) as an ion?

What is allotropy, and how is it illustrated and accounted for in the case of the element oxygen?

3 Complete the following equations, using formulas:

Barium chloride + sodium sulphate =
Hydrogen sulphide + bismuth chloride =
Ammonium chloride + calcium oxide =
Sulphur dioxide + chlorine + water =

Give the name and formula of (*a*) a binary compound, (*b*) an acid containing oxygen, (*c*) a base, (*d*) a normal salt.

B

4 State all that takes place when steam is passed over heated iron. How may the gaseous product of the reaction be identified? Make a sketch of an apparatus which might be used to carry out this experiment.

Outline an experiment to illustrate the synthesis of water, making use of the solid product of the above reaction.

5 Under what conditions is native sulphur usually found? Name two classes of sulphur compounds which occur in nature.

How may sulphur dioxide be prepared (*a*) by an oxidizing process, (*b*) by reduction?

Name two ways in which an aqueous solution of sulphur dioxide may be distinguished from one of hydrogen sulphide.

6 State the important chemical and physical properties of nitrogen. How is nitrogen prepared from the atmosphere? Name another element which the gas contains when thus prepared.

How is nitric acid prepared in the laboratory, and what are its important properties? Name two different ways in which its salts may be prepared.

C

7 Compare the properties of the two common modifications of phosphorus. What is the formula of the product of the combustion of phosphorus in oxygen, and what name is given to this compound which indicates its chemical behavior?

Explain the difference in composition and use of the common "parlor (friction) match", and the "safety match."

8 Name two metals which are not readily acted upon by the constituents of the atmosphere. For what purposes does this property of these metals render them particularly serviceable?

Give the names and formulas of three oxides of iron.

State two ways by which an aqueous solution of a copper salt may be distinguished from one of a ferric salt.

9 Show how each of the following substances may be obtained from marble: (*a*) carbon dioxide, (*b*) quick lime, (*c*) slaked lime, (*d*) calcium chloride. Write equations indicating the changes which occur in each case. How may the carbon dioxide be identified?

D

10 The formula of ethane is C_2H_6. Calculate the specific gravity of its vapor (*a*) compared with hydrogen, (*b*) compared with air.

Find the proportions by weight and volume in which ethane gas (C_2H_6) will combine with oxygen. [Atomic weights: $C = 12$, $O = 16$.]

11 A quantity of hydrogen measures 76 liters at 100° C. and 746 mm. pressure. Calculate its weight. [A liter of hydrogen weighs 0.0899 grm. under standard conditions.]

How much sodium, by its action upon water, is required to furnish the above weight of hydrogen? [Atomic weight of $Na = 23$.]

Examiners

Henry P. Talbot	Charlotte F. Roberts	Albert Cable Hale
Massachusetts Institute of Technology	Wellesley College	Boys' High School, Brooklyn, N. Y.

CHEMISTRY

1902

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

Thursday, June 19 **DRAWING** 10–11.45 a. m.

EXAMINATION FOR ADMISSION TO COURSES IN ARCHITECTURE, ENGINEERING AND APPLIED SCIENCE

Candidates for courses in Architecture will take Exercises A and B.

Candidates for courses in Engineering and Applied Science will take Exercises A and either B or C, as they may prefer.

Thirty minutes and no more shall be given for the first exercise. If this drawing is not completed by 10.30 it should be left unfinished and work should be begun on the second exercise.

The second exercise should occupy all the remaining time.

An incomplete drawing correctly laid out and executed by correct method is better evidence of proficiency than a completed drawing, incorrect in construction and slovenly in execution.

Use a soft pencil with a light touch.

All work must be genuine free-hand work without assistance from measuring slips, instruments, or artificial aids of any kind.

Accuracy of form is of more account than finish of execution.

Students are advised not to erase completely the construction lines.

EXERCISE A — Draw a circle about 3 inches in diameter and inscribe within it a five-pointed star.

EXERCISE B — Draw in pencil the outline ornament pattern Fig. *B* upon the accompanying sheet, enlarging it so as to occupy a space about 4 inches square.

EXERCISE C — Draw in pencil, with or without shading, the piece of machinery Fig. *C* upon the accompanying sheet, enlarging it so as to occupy a space of about 5 inches in height on the paper.

EXAMINATION FOR ADMISSION TO COURSES IN GENERAL SCIENCE

Use a soft pencil with a light touch.

All work must be genuine free-hand work without assistance from measuring slips, instruments, or artificial aids of any kind.

Accuracy of form is of more account than finish of execution.

Students are advised not to erase completely the construction lines.

EXERCISE A — Make a free-hand outline drawing, slightly reduced, from the accompanying colored print of a spray of foliage and flowers.

EXERCISE B — Draw in pencil the outline ornament pattern Fig. *B* upon the accompanying sheet, enlarging it so as to occupy a space about 4 inches square.

Examiners

ALFRED E. BURTON	ALFRED D. F. HAMLIN	MANTON E. MERCHANT
Massachusetts Institute *of Technology*	Columbia University	Erasmus Hall High School, Brooklyn, N. Y.

College Entrance Examination Board
Post-Office Sub-Station 84, New York, N. Y.

DRAWING

Thursday, June 18 9.30–12 a. m.

EXAMINATION FOR ADMISSION TO COURSES IN ARCHITECTURE, ENGINEERING AND SCIENCE

Thirty minutes and no more shall be given for the first exercise. If this drawing is not completed by 10 a. m. it should be left unfinished and work should be begun on the second exercise.

If the second exercise is not finished by 10.30 a. m. it should be left unfinished and work should be begun on the third exercise.

If the third exercise should be finished before 12 m. the candidate is at liberty to devote the remaining time to the completion of the first and second exercises.

An incomplete drawing correctly laid out and executed by correct method is better evidence of proficiency than a completed drawing, incorrect in construction and slovenly in execution.

Use a soft pencil with a light touch.

All work must be genuine free-hand work without assistance from measuring slips, instruments, or artificial aids of any kind.

Accuracy of form is of more account than finish of execution.

Students are advised not to erase completely the construction lines.

Exercise A — Draw two concentric circles, the outer one about 4 inches in diameter and the inner one about 3 inches in diameter.

Inscribe in the smaller of these circles a regular six-pointed star.

Exercise B — Draw in pencil the outline design, Fig. B, enlarging it so that the width shall be about 4½ inches.

Exercise C — Make a drawing in outline of the object designated by the person in charge of the examination.

Examiners

John Henry Barr	Alfred D. F. Hamlin	Manton E. Merchant
Cornell University	Columbia University	Erasmus Hall High School, Brooklyn, N. Y.

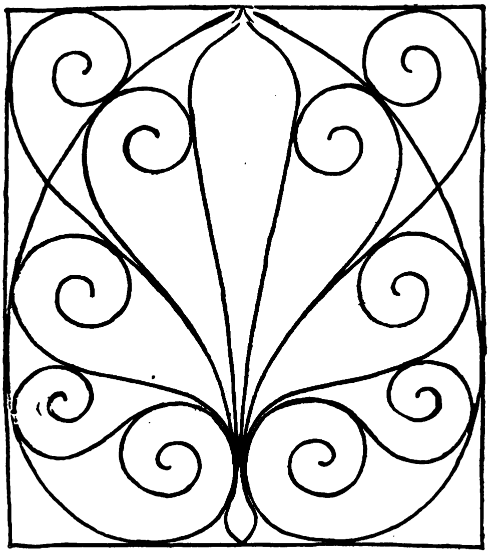


FIG. B

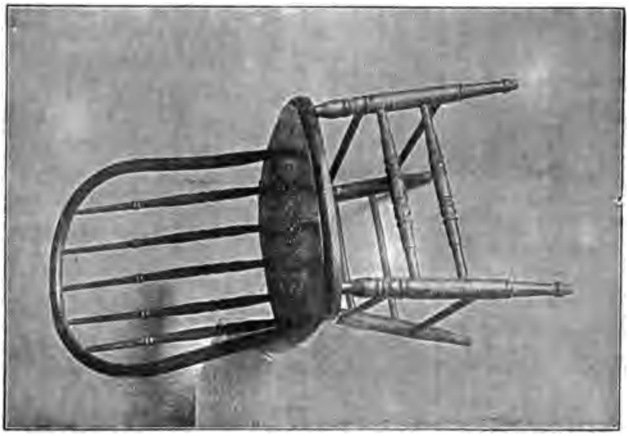
College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

DRAWING

INSTRUCTIONS TO SUPERVISOR

The subject for Exercise C is to be a common chair without arms, laid upon its side on a table, so as to present an aspect somewhat like that shown in the print given below. Although it will not be possible for all candidates to obtain this exact view, they should as far as possible be grouped on the same side of the table. If the table be placed near one corner of the room, sufficient uniformity of relative position will be secured for all candidates. It is not essential that the chair used shall be of exactly the form shown in the illustration, but it should have about the same general character as to complexity.



1904

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

DRAWING

Thursday, June 23 9.30–12 a. m.

EXAMINATION FOR ADMISSION TO COURSES IN ARCHITECTURE, ENGINEERING AND SCIENCE

One hour and no more should be devoted to the first exercise. If this drawing is not completed by 10.30 a. m. it should be left unfinished and work should be begun on the second exercise.

If the second exercise should be finished before 12 m. the candidate is at liberty to devote the remaining time to the completion of the first exercise.

An incomplete drawing correctly laid out and executed by correct method is better evidence of proficiency than a completed drawing, incorrect in construction and slovenly in execution.

Use a soft pencil with a light touch.

All work must be genuine free-hand work without assistance from measuring slips, instruments, or artificial aids of any kind.

Accuracy of form is of more account than finish of execution.

Students are advised not to erase completely the construction lines.

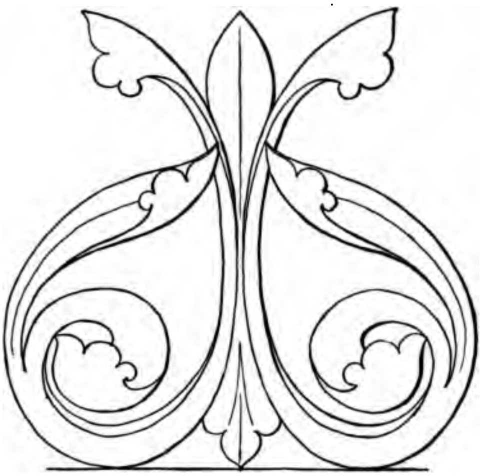
EXERCISE A — Draw in pencil the outline design Fig. A, enlarging it so that the width shall be about 4½ inches.

EXERCISE B — The diagram B represents a square frame made of sticks having a square cross-section, and enclosing a circular ring of similar cross-section: the outer dimension of the square frame is supposed to be about 5 inches.

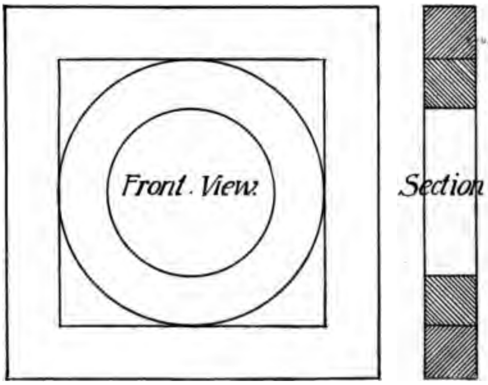
Make a free-hand sketch of this object as it would appear in some position presenting it obliquely to the view. Represent it approximately of the dimensions above specified, with the invisible edges dotted or lightly indicated. Isometric perspective may be employed if the candidate prefer.

Examiners

ALFRED D. F. HAMLIN	CHARLES L. ADAMS	MANTON E. MERCHANT
Columbia University	Massachusetts Institute of Technology	Erasmus Hall High School Brooklyn, N. Y.



Exercise A



Exercise B

1905

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

DRAWING

Thursday, June 22 9.30–12 a. m.

EXAMINATION FOR ADMISSION TO COURSES IN ARCHITECTURE, ENGINEERING AND SCIENCE

Candidates must answer one question from each group.

One hour and no more should be devoted to the first exercise. If this drawing is not completed by 10.30 a. m. it should be left unfinished and work should be begun on the second exercise.

If the second exercise should be finished before 12 m. the candidate is at liberty to devote the remaining time to the completion of the first exercise.

An incomplete drawing correctly laid out and executed by correct method is better evidence of proficiency than a completed drawing, incorrect in construction and slovenly in execution.

Use a soft pencil with a light touch.

All work must be genuine free-hand work without assistance from measuring slips, instruments, or artificial aids of any kind.

Accuracy of form is of more account than finish of execution.

Students are advised not to erase completely the construction lines.

GROUP I

EXERCISE A — Make a perspective drawing (size from 2 to 3 inches) of a cube so placed that it will have three vanishing points, none of which shall fall on the horizon. Give approximate tests of the accuracy of the perspective.

EXERCISE B — A cube rests on one of its faces, its upper horizontal face being below the level of the eye and the visible vertical faces being turned at unequal angles to the spectator. On the central point of the upper face rests the central point of the base of a square pyramid, the edges of its base are slightly shorter than the edges of the cube and are parallel with the edges of the cube's upper face; the height of the pyramid is twice that of the cube. Assume the light as coming from above and from the left.

Make a sketch of the above, including light, shade, and cast shadow, the height of the sketch being about six inches.

GROUP II

Exercise A—Make, from memory, a sketch of any common object, plant form, or piece of ornament. The drawing may be a perspective, or may consist of two or more projections.

Exercise B—Make a drawing of Fig. A, enlarging to twice the size.

Exercise C—Make a drawing of Fig. B, enlarging to twice the size.

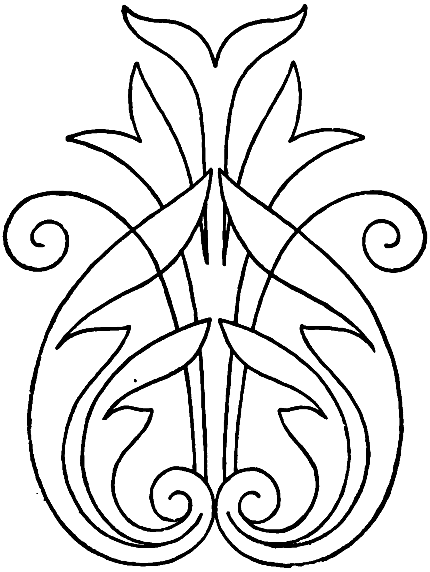


Fig. A

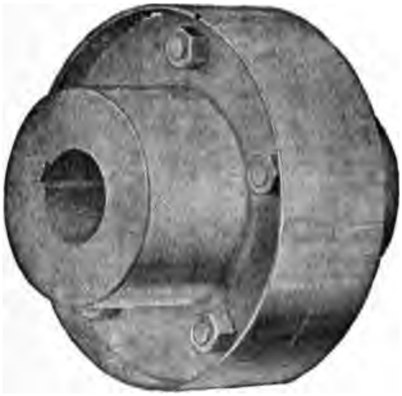


Fig. B

Examiners

Ralph E. Mayer Columbia University	Charles L. Adams Massachusetts Institute of Technology	Manton E. Merchant Erasmus Hall High School, Brooklyn, N. Y.

GEOGRAPHY

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

Saturday, June 21 **GEOGRAPHY** 11 a. m.–12.30 p. m.

In this examination 40 counts will be based upon the laboratory note book, and 60 upon the following questions:

1 How does the inclination of the earth's axis affect the length of day and night in different latitudes and at different seasons?

2 What is a cyclonic storm? What is the ordinary path of temperate latitude cyclones as shown in the United States? How is it possible to predict the weather?

3 Give the distribution of rainfall in the United States west of the Mississippi river. Discuss the cause of such distribution, and its effects upon vegetation.

4 Describe the currents of the Atlantic ocean.

5 Name and briefly describe two plateaus, one slightly dissected and one maturely dissected.

6 Describe the development of meanders. Show how meandering causes widening of valleys, and explain the making of a cut-off.

7 Define glacier, crevasse, moraine, drumlin.

8 What are the means of migration, active and passive, of animals and plants? Discuss barriers which limit migration.

Examiners

ALBERT PERRY BRIGHAM	WILLIAM NORTH RICE	FRANK CARNEY
Colgate University	Wesleyan University	Ithaca High School, Ithaca, N. Y.

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

GEOGRAPHY

Saturday, June 20 1-2.30 p. m.

Answer any six of the following questions:

In this examination 40 counts will be based upon the laboratory note-book, and 60 upon the following questions:

1 Give several reasons for believing that the earth is round.

2 Contrast the oceanic and the continental type of climate.

3 Explain the relation between wind direction, wind velocity and barometric pressure.

4 Define the quiet and the explosive type of volcanic eruption, describing an example of each.

5 Describe conditions of rock strata most favorable for artesian wells, and illustrate by diagram.

6 Contrast, as to several important features, a young with an old river valley.

7 Give the most important geographic reasons for the development of Albany, Pittsburg, Duluth and San Francisco.

8 Explain as fully as you can the cause of the tides, illustrating by diagram. What are the causes of variations in the tides?

Examiners

Albert Perry Brigham
Colgate University

William North Rice
Wesleyan University

Frank Carney
Ithaca High School,
Ithaca, N. Y.

1904

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

GEOGRAPHY

Saturday, June 25 1–2.30 p. m.

In this examination 40 counts will be based upon the laboratory note-book, and 60 upon the following questions.

Answer one question each from groups A and B, and two questions each from groups C and D.

A

1 What would be the effect on day and night (*a*) if the earth's axis were perpendicular to the plane of its orbit, (*b*) if it were inclined 45° to the plane of its orbit? What would be the effect upon the seasons in the northern hemisphere in case of either of the above changes?

2 Within what limits does the length of a degree of longitude vary? How does the length of a degree of latitude vary and why? How is latitude measured?

B

3 Describe the general form of the ocean bottom; state the variation of temperature of ocean waters with latitude and depth, and name the important ingredients held in solution.

4 State the several kinds of movement of ocean waters; select any one of these and describe the effects produced by it on the sea bottom and on the forms of adjacent lands.

C

5 What is meant by the expression "low barometer" and why does a falling barometer indicate bad weather? Describe the changes of weather conditions at a place to the southeast of the track over which a "low" moves.

6 What relations exist between (*a*) temperature and movements of the atmosphere, (*b*) temperature and humidity, (*c*) temperature and pressure, (*d*) humidity and pressure?

7 Describe the general atmospheric circulation of the earth and give reasons for the directions of movement.

8 What are the principal causes which determine the amount of rainfall which a region will have? Name places which illustrate the effects of these causes.

D

9 Describe the Colorado canyon and the Platte river channels and state the conditions to which the differences between them are due.

10 Describe the characteristics of young and of mature rivers as regards longitudinal profile, form of valley, and development of river system. Give an example of each of the two types.

11 What is the effect of the former elevation or depression of a coast region upon the location of settlements and the occupation of its inhabitants? Illustrate by the coastal regions of the United States.

12 Compare the influence of a coastal plain and of an inland mountain region on the social and industrial life of the inhabitants.

Examiners

Albert P. Brigham	Florence Bascom	William H. Snyder
Colgate University	Bryn Mawr College	Worcester Academy Worcester, Mass.

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

GEOGRAPHY

Saturday, June 24 1–2.30 p. m.

In this examination 40 counts will be based on the laboratory note book, and 60 counts on the following questions.

Answer one question each from groups A and B, and two questions each from groups C and D.

A

1 The earth is nearest the sun about January first. How then can January be a winter month? Explain with the use of a diagram, the cause of the change of seasons.

2 What are four consequences of the form and rotation of the earth? Which one do you regard as most important and why?

B

3 How do tides at any one locality vary from day to day, in time of arrival and in height? Why?

4 The Galapagos Islands west of South America and almost on the equator have no coral reefs, while the Bermudas east of North America and in latitude 32° have coral reefs. Explain the difference. State a theory for the formation of atolls.

C

5 *a* What are the lowest mean annual temperatures that have been recorded, and where are they found? Account for their location.

b Account for the bending of the isotherms on the western coasts of North America and South America.

c At what time of the year and at what localities are isotherms most crowded, and why?

6 The west central coast of North America has a large amount of rainfall, but the west central coast of South America is very dry. Explain this difference.

7 *a* Distinguish between cyclones and anti-cyclones; between a cyclone and a tornado.

b Explain the effects of cyclonic storms upon climate and trace the regular storm paths through the United States.

8 Explain the origin of an arid region. What is the character of its plant life? How do desert conditions affect man as regards mode of life, agriculture and other industries? Give illustrations from western America and from other lands.

D

9 Give three proofs that an extensive ice sheet passed over the northern part of the United States at some former time. Name four physiographic forms due to glacial action and give a locality where each may be found.

10 Name the kinds and indicate the position of rock strata most favorable for artesian wells. Illustrate by a diagram.

11 Describe a typical example of a coastal plain.

12 Describe a region with transverse and longitudinal valleys and explain the origin of such an arrangement.

Examiners

ALBERT P. BRIGHAM Colgate University	FLORENCE BASCOM Bryn Mawr College	WILLIAM H. SNYDER Worcester Academy, Worcester, Mass.

PHYSICS

College Entrance Examination Board

OF THE

MIDDLE STATES AND MARYLAND

SUB-STATION 84, NEW YORK, N. Y.

Monday, June 17 **PHYSICS** 3–4.30 p. m.

In this examination 28 counts will be based on the laboratory note book submitted by the candidate and 72 on the following questions. The candidate is to answer six questions, selecting one from each of the groups (A, B, C, D, E and F).

A

1 A balloon contains 500 cubic meters of hydrogen, each cubic meter of which weighs 90 grams. The material of the balloon weighs 250 kilograms. Each cubic meter of the surrounding air weighs 1290 grams. How many kilograms in addition to its own weight will the balloon lift?

2 Describe a method of finding the specific gravity of a solid heavier than water; of a liquid.

B

3 A cylindric bar of uniform diameter and 1.5 meters long has a strong ring fastened to each end and another at a distance of one meter from one end. Show by three drawings how this rod may be used as a lever with each ring in turn serving as a fulcrum. What weight in each case (the weight of the bar itself being neglected) applied to one remaining ring will balance 25 kilograms at the other?

4 A steamer is moving eastward at the rate of 240 meters per minute. A man runs northward across her deck at the rate of 180 meters per minute. Show by a drawing his actual path and compute his actual velocity in centimeters per second.

C

5 If the specific heat of iron is .113, what will be the final temperature of 4 kilograms of iron taken from boiling water at 100° C and plunged into 4 kilograms of water at a temperature of 12° C?

6 What is the name of the process by which heat is transmitted from the sun to the earth? Give other examples of the same process. By what means, mainly, is heat distributed throughout a vessel of water on a stove? Give other examples of this process. What is the name of the process by which heat is transmitted along a metal rod one end of which is hotter than the other? Name several substances in the order of the facility with which they transmit heat by this last named process.

D

7 Musical tones may differ in *loudness*, in *pitch* and in *timbre* (or clang). Define each of the three above mentioned terms.

8 The ground glass of a camera, 15 centimeters from the optical center of the lens receives a perfect image of an object 50 centimeters away. What is the focal length of the lens?

E

9 Given two bar magnets the poles of which are not marked. How would you locate the north seeking pole of each? How would you determine which is the more strongly magnetized? Why is it that a magnetized bar or needle, suspended at its center tends to set itself parallel to the lines of force of the earth's magnetic field but is not drawn bodily towards the north pole of the earth?

10 Make a diagram showing the essential parts and arrangement of *one* of the following: *a*) a simple form of dynamo, *b*) an electric bell, *c*) a galvanometer. Describe briefly.

F

11 What apparatus would you use in comparing the electric resistances of ten meters each of copper wire and of German silver wire? Describe briefly the method which you would employ.

12 How would you arrange a set of six voltaic cells, the electromotive force of each cell being 1.5 volts and its resistance .75 ohms, to obtain the largest current in a circuit having an external resistance of one ohm? How would you arrange the cells to obtain the largest current in a circuit with an external resistance of 86 ohms? What current would you expect to obtain in the latter case?

Examiners

EDWARD L. NICHOLS	WILLIAM S. FRANKLIN	FRANK ROLLINS
Cornell University	Lehigh University	Peter Cooper High School, New York city

1902

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

Monday, June 16 **PHYSICS** 3–4.30 p. m.

In this examination 40 counts will be based on the laboratory note book submitted by the candidate and 60 counts on the following questions. The candidate is to answer six questions, selecting one from each of the groups (A, B, C, D, E and F).

A

1 A solid body weighs 70 grams in air, 40 grams in water and 43 grams in an alcohol solution. What is the specific gravity of the solid body and the specific gravity of the alcohol solution?

2 A dealer buys gold at a port in Alaska and sells it in New York. Might the quantity of gold be ascertained more fairly in terms of *mass* or of *weight?* Why? Would the dealer lose or gain by weighing the gold with a spring balance in Alaska and reweighing it with the same balance in New York? Why?

B

3 A freely moving body acted upon by a constant force moves 5 meters during the first second. How far will it move during the fourth second? Explain.

4 A given bottle will burst when subjected to an internal pressure of 50 kilograms per square centimeter. The bottle takes a cork having a diameter of 2 centimeters. The bottle is filled with water. Calculate the force with which the cork must be pushed into the bottle to burst it, the friction of the cork against the neck of the bottle being neglected. Why can not the bottle be burst by pushing in the cork when the bottle is filled with air?

C

5 Illustrate the terms potential energy, kinetic energy, transformation of energy, conservation of energy and dissipation of energy by discussing the winding and running of a watch.

6 A man lifts 100 kilograms through a vertical distance of 5 meters by means of a wheel and axle. How much work, neglecting friction, must he do (*a*) in kilogram-meters, (*b*) in ergs? Compare the power required if this work is done in 10 minutes with that necessary to do it in 60 minutes.

D

7 The temperatures of boiling water on a high mountain, at sea level and in a boiler which furnishes steam to a steam engine are different. Which is hottest and which coolest? Why?

Describe an experiment showing the influence of pressure upon the boiling point of a liquid.

8 A piece of metal weighing 500 grams is heated to 100° C and plunged into 250 grams of water at 10° C. The resulting temperature is 15.5° C. Find the specific heat of the metal.

E

9 What is meant by a *node* on a vibrating string? By an *antinode?* What is a node in a long vibrating air column, such as the air column in an organ pipe? Compare the movements of the air on opposite sides of a node in an organ pipe.

10 The essential parts of a telescope are the *object-glass* and *eye-piece.* Explain the function of each. Give a diagram.

F

11 Describe three possible arrangements of six voltaic cells whose E. M. F. is 1.5 volts each, and internal resistance 10 ohms each. By calculation show which arrangement will give the greatest current in a circuit the external resistance of which is 3 ohms.

12 What is meant, in electricity, by the term *induced current* (or induction current)? Describe some device for the production of such currents and explain its action.

Examiners

EDWARD L. NICHOLS Cornell University	WILLIAM S. FRANKLIN Lehigh University	FRANK ROLLINS Peter Cooper High School, New York city

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

PHYSICS

Monday, June 15 3–4.30 p. m.

In this examination 40 counts will be based on the laboratory note-book submitted by the candidate and 60 counts on the following questions. The candidate is to answer six questions, selecting one from each of the groups (A, B, C, D, E and F).

A

1 Define five of the following terms and give one or more examples or illustrations of each: *mass*, *density*, *weight*, *tensile strength or tenacity* *velocity*, *momentum*, *energy*.

2 Describe a quick commercial process for finding the density of liquids. What is the name of the instrument used, and upon what principle does its action depend?

B

3 A wooden bar of uniform cross-section, 100 cm. long, weighs 1.5 kilograms. It is supported at a point 25 cm. from one end. If to this end a weight of 7.5 kilograms is attached, what weight at the other end will suffice to balance the bar?

4 A glass bulb weighs 75.405 grams when filled with air at standard pressure and temperature. It weighs 74.309 grams with the air pumped out. It weighs 74.422 grams when filled with hydrogen at standard pressure and temperature. What is the specific gravity of hydrogen referred to air as a standard?

C

5 Under what conditions does a force acting upon a body do work? How may we calculate the amount of work done? Define the terms *erg*, *kilogram-meter*.

6 A toboggan slide has a vertical height of 20 meters. At the bottom of this slide is a long level stretch. Three men starting at the bottom climb to the top of the slide carrying the toboggan upon which they subsequently descend. The three men with the toboggan weigh 200 kilograms. The slide itself is assumed to be frictionless, while the level stretch offers considerable resistance to the movement of the toboggan Describe the transformations of energy (*a*) in the ascent, (*b*) in the descent, (*c*) in the run along the level stretch. Compute the amount of energy involved in each transformation.

D

7 Describe an experiment showing that a piece of metal increases in dimensions with rise of temperature. Give three practical applications of this property of metals.

8 Describe a process for determining the amount of heat required to melt one gram of ice. Which weights should be most carefully determined? Why?

E

9 Explain why the bell of a swiftly approaching bicycle seems to give a tone of different pitch from that given by the same bell after it has passed the observer. What further change in the sound of the bell may be noted as the bell recedes from the observer? State the exact law of the latter change.

10 Describe a method for finding the candle-power of an electric lamp. Show the essential parts of the apparatus in a simple drawing.

F

11 Draw a diagram of an electric circuit containing a battery, a push button and an electric bell. Show particularly the electrical connections of the mechanism of the bell, and explain how the bell clapper is kept continuously in vibration so long as the circuit at the push button is closed.

12 *a* The two branches of a divided electric circuit have resistances of 3 ohms and 5 ohms respectively. The total current in the circuit is 24 amperes. What is the current in each branch? Explain.

b If you wished to insert a battery in a line of telegraph wire, between stations, how would you determine the direction of the current already flowing in the line?

Examiners

EDWARD L. NICHOLS Cornell University	WILLIAM S. FRANKLIN Lehigh University	FRANK ROLLINS Morris High School, New York city

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

PHYSICS

Monday, June 20 2.55–4.25 p. m.

In this examination 40 counts will be based on the laboratory note-book submitted by the candidate and 60 counts on the following questions. The candidate is to answer six questions, selecting one from each of the groups (A, B, C, D, E and F).

A

1 A wooden block whose specific gravity is 0.75 weighs 48 grams. If the block were floated in water with what force would one need to push downward upon it to hold it under water?

2 Draw and describe the essential parts of a mercurial barometer. Account for the change in the height of the column of mercury (*a*) when the barometer is carried to the top of a high mountain, (*b*) when carried to the bottom of a deep mine.

B

3 Using the formulae for free fall and a formula for work, prove that the expression for kinetic energy should contain velocity squared.

4 Why is the vibration frequency of a spring practically the same for all amplitudes?

C

5 Describe an experiment for determining the coefficient of linear expansion of a metal or an experiment for finding the specific heat of a metal. In your chosen experiment state what special devices or precautions you would employ to make the error in your result as small as possible.

6 Show (*a*) by describing some simple experiment how the pitch of a sound is related to the frequency of vibration, (*b*) by describing some experiment or common experience whether sounds of different pitch travel at the same velocity, (*c*) the necessary relation between pitch and wave-length.

D

7 Will an ordinary suction-pump raise boiling water if its valves are above the level of the water? Give your reasons.

8 Describe the essential features of the phonograph and explain its action.

E

9 With a diagram show how you would locate the image of an object (e. g. a right triangle with unequal arms) in a plane mirror. Indicate the kind, magnitude and position of the image.

10 Explain with a diagram why an object, to be seen clearly, can be held closer to the eye when viewed through a convex lens than it can be held when viewed without a lens.

F

11 Show by a diagram how you would arrange a battery, commutator, galvanometer and a coil of wire to be tested for resistance so as to reverse the current through the galvanometer but not through the coil to be tested.

12 What explanation is commonly given to account for the difference between a magnetized bar of steel and an unmagnetized bar of steel? How do you account for the magnetization and demagnetization of a bar of soft iron when brought into and out of a strong magnetic field? Why do steel tools, kept upright, become magnets in course of time?

Examiners

EDWARD L. NICHOLS Cornell University	FRANCIS C. VAN DYCK Rutgers College	FRANK ROLLINS Morris High School, New York, N. Y.

College Entrance Examination Board

Post-Office Sub-Station 84, New York, N. Y.

PHYSICS

Monday, June 19 2.55–4.25 p m.

In this examination 30 counts will be based on the laboratory note book submitted by the candidate and 70 counts on the following questions. The candidate is to answer seven questions, selecting two from each of the groups A, B and C, and one from group D.

A

1 Make a drawing showing a tumbler of water and a tumbler of mercury (in vertical cross section) with a fine and a coarse capillary tube standing in each. Represent the relative levels and general shapes of the liquid surfaces in tumblers and tubes. State one law of capillary action.

2 A ball starting from rest and rolling down a smooth inclined plane for three seconds moves five meters during the last second. What is its acceleration? How far did it move during the three seconds?

3 Explain the steps in the transfer of heat from the fire under the boiler to a room containing coils of pipes which receive steam from the boiler.

B

4 A wire stretched with a certain force gives a tone of definite pitch. How much must the tensile force be increased to raise the pitch one octave?

5 A photographer takes two pictures of the same person, one with the camera two meters away, the other with the camera three meters away. What effect will the change in the distance of the camera have upon the size of the face in the picture and upon the distance between the lens and the sensitive plate?

6 Make a diagram showing a concave mirror, an object and an image formed by light coming from the object. Explain your construction.

C

7 What is the function of the armature of a dynamo and why should it have an iron core?

8 A covered kettle boils much more quickly than an open kettle. Account for the heat which is saved, in various ways, by the cover.

9 A body of water in a calorimeter is heated by sending a strong current of electricity through a coil of wire submerged in the water. If the current through the coil be doubled, what will be the effect upon the amount of heat received by the water from the coil?

D

10 Two similar voltaic cells, each having an electromotive force of 1.4 volts and an internal resistance of 3 ohms are connected in series. They then give a current of 0.2 amperes. What is the resistance of the connecting wire? What current would pass if the connecting wire were of the same material but twice as long and of twice the cross section?

11 A lump of alum whose specific gravity is 1.67 weighs 12.81 grams when submerged in kerosene oil having a specific gravity of 0.78. What is the weight of the alum in air?

12 From the following data compute the amount of heat required to melt one gram of ice:

Weight of calorimeter 174.2 grams.
Weight of calorimeter and water 707.9 grams.
Weight of calorimeter and water and ice 882.8 grams.
Initial temperature of water 49.4° C.
Final temperature of water 18.2° C.

Examiners

EDWARD L. NICHOLS Cornell University	FRANCIS C. VAN DYCK Rutgers College	FRANK ROLLINS Stuyvesant High School, New York, N. Y.

[illegible]

To avoid fine, this book should be returned on
or before the date last stamped below

5M—1-38

DEC 2 [illegible] Faculty

NOV 27 1967

Stanford University Libraries
3 6105 005 037 333

378.211
C697e

524011

LI EDUCATION

GINN & COMPANY
BOSTON
NEW YORK
CHICAGO
LONDON
ATHENAEUM PRESS